"A Price Theory of Multi-sided Platforms":
A Critical Review of the Study of Weyl (2010)
Industrial Economics 1 (ECO-M011)

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Weyl (2010) addresses the topic of multi-sided markets, developing a general price theory in the case of monopoly. This strand of literature can be considered relatively recent, as seminal contributions in this field date back to early 2000s, and this paper remarkably contributes in improving our understanding of the factors that drive the pricing choices in such a market, with a formal model of pricing in a two-sided market and an extension to multi-sided cases.

A multi-sided market is a market within which two (or more) groups of agents interact with each other through the intermediation of one (or more) platform(s). Two-sided markets are based on externalities: the utility of an agent on one side depends on the presence of – or the interaction with – the agents on the other side[1].

Therefore, in two-sided markets a special type of network externality arises. While network externalities usually render the value of a product or service dependent on the number of other consumers using it, in a two-sided market the utility increases as consumption of agents on the other side increases (*inter-side externality*). However, this does not rule out the possibility that usual network effects arise within a side (*intra-side externality*)[2]. Another interesting distinction concerns the source of the externality itself: Rochet, Tirole (2003) distinguishes between *membership externality*, occurring when an additional membership on one side benefits the opposite side

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[1] A classical example of this market structure is the credit card market: a platform, the card issuer, allows the interaction between cardholders and merchants; in their decision to join a credit card platform, consumers consider the number of merchants accepting it for payment, whereas merchants will consider joining the platform depending on how much the card is spread among consumers. This market structure is quite common in the media industry as well, where newspapers or TV broadcasters intermediate between consumers and advertisers.

[2] E.g., Belleflamme, Toulemonde (2004) analyzes a case with both positive inter-side externalities and negative intra-side externalities.

members, and *usage externality*, when the benefit is originated by an additional transaction. Accordingly, we can also distinguish between *membership* and *usage fees*, on the basis of the pricing instruments that are available to platforms[3].

In considering the platforms' pricing strategies, the economics literature distinguishes between *price level*, which is the sum of the prices charged by a platform on both sides, and *price structure*, which is instead the allocation of the price level among the two sides. According to Rochet, Tirole (2006), this distinction is the core of a more restrictive definition of a two-sided market: for a market to be two-sided, the price structure must be non-neutral, i.e., the volume of transactions and the participation levels vary as the price structure varies, holding the price level constant.

The pricing choices of a platform in a two-sided context have been formally explored by, among others, Rochet, Tirole (2003), Armstrong (2006) and Rochet, Tirole (2006)[4]. Rochet, Tirole (2003) assumes the presence of inter-side usage externalities among agents of the two sides (end-users), whereas the monopoly platform charges a usage fee and incurs in a per-transaction cost. Moreover, end-users are heterogeneous in the benefit they obtain from an interaction. In equilibrium, the price level charged by a profit-maximizing platform will be given by the classical Lerner formula, where elasticity is the sum of the two elasticities in each side. Though, the main peculiarity lies in how this total price is allocated between the two sides: the price charged on one side is equal to the one charged in the other (+), multiplied by the ratio between the elasticity on the first side (+) and the elasticity of the second (-)[5].

Armstrong (2006) considers instead membership inter-side externalities and membership fees, and the platform incurs in a per-participant cost. Heterogeneity among end-users is given by differences in their membership values, whereas interaction values are assumed to be homogeneous. In equilibrium, when the platform maximizes its profit, price on one side is given by the cost of providing the service, adjusted downwards by the inter-side externality effect and adjusted upwards by the elasticity of demand on that side. So, prices reflect the external benefit

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[3] For the definitions provided in this section, credit goes to Roson (2005).
[4] In this essay, focus will be on the pricing choices made by a monopoly platform. In fact, this is the only case formally analysed by Weyl (2010).
[5] In round brackets, the effect of an increase on the price charged to the first side.

given by one group to the other, and this means that one side can even be subsidized by the other if the presence of members from the first side is of great value to members of the second[6].

Rochet, Tirole (2006) builds a more general case in which: the platform incurs in both per-member and per-transaction cost and charges both membership and usage fees; end-users' gross utility is given by a per-transaction benefit minus fixed cost from participation, and they are heterogeneous in both. However, users on each side of the market are of equal value to those on the other side. Again, the price level is given by a re-interpretation of the Lerner formula, but this time with a correspondent reinterpretation of marginal cost as an opportunity cost: the marginal cost of serving an extra member on one side is lowered by the fact that the additional participation increases the willingness to pay of agents on the other side. More generally, Rochet, Tirole (2006) individuates a *topsy-turvy principle*: "A factor that is conducive to a high price on one side, to the extent that it raises the platform's margin on that side, tends also to call for a low price on the other side as attracting members on that other side becomes more profitable".

The analysis in Weyl (2010) aims at generalizing the model in Rochet, Tirole (2006), starting from an intuition: although they are both undoubtedly two-sided markets, the industry of credit cards and that of newspapers seem to work quite differently. This is because cardholders differ in the usage value they obtain from a transaction, whereas readers are heterogeneous in the value that their membership brings to advertisers, as high income readers are usually more valuable to advertisers. So, in a sense, the problem of a monopoly platform in such a context is also that of setting the quality of the service provided, since the composition of participation on one side determines the quality of the platform on the other.

Therefore, in his model the author allows end-users to be heterogeneous along two dimensions, the membership externality and the usage externality, such that Armstrong (2006) and Rochet, Tirole (2003) can be considered special cases of this more general setting. Another innovation of the setting lies in the fact that the platform is assumed to choose directly a participation level on both sides, instead of choosing the price structure that leads to those participation levels. This is to avoid the equilibrium multiplicity that may arise with a pair of membership fees. In fact, this multiplicity is considered to be inessential to the analysis of a two-

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[6] E.g., free newspapers obtain their revenues (and profits) from the advertisers' side of the market, inasmuch they set a price below marginal costs to readers. This is why advertisers want their ads to be as widespread as possible, whereas readers dislike them.

sided market, since a given pair of participation levels is sufficient in order to uniquely determine the correspondent prices, profit and social welfare[7].

Given this setting, Weyl (2010) analyses two different cases, depending on the objective function of the monopoly platform: 1) unconstrained welfare maximization and 2) profit maximization[8]. In case 1), the social planner chooses the optimal participation level by equating marginal social benefits to marginal costs; this leads to a price that resembles the standard Pigouvian condition: the price charged to one side equals the private cost of providing the service lowered by the external benefit that additional consumption generates. In case 2), the monopolist chooses the optimal participation level by equating marginal revenues of participation to marginal costs. If compared to case 1), the resulting equilibrium price in one side is adjusted upwards by two factors: a market power distortion and a "Spence distortion"[9]. The latter is given by the difference between the average usage externality and the marginal usage externality on the other side, multiplied by the participation level on that side, i.e., it is the part of externality that is not internalized by the platform. This Spence distortion is equal to zero if we do not allow consumers to be heterogeneous in terms of usage externality, since the average usage externality would be equal to the marginal; it is negative if the usage externality is negative[10].

As mentioned above, Weyl (2010) generalizes the previous most relevant works in this strand of literature by allowing heterogeneity of users along two dimensions, and this can be considered a major achievement itself. Moreover, allowing a double dimension of heterogeneity permits to obtain a better fit for many two-sided markets[11], leading to a more precise predictive power. Furthermore, the use of participation levels as a strategic variable successfully avoids coordination problems, and may help focusing on the relevant issues when such problems are not significant.

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[7] The instrument used by the author to obtain the desired participation levels is the "insulating tariff". It also permits to overcome the coordination problem that may be faced by a platform in having both sides "on board". This problem is known as *chicken & egg problem* (Caillaud, Jullien, 2003).

[8] A third case of welfare maximization with platform's profit at least equal to a fixed level is omitted here for brevity.

[9] This definition is inspired by Spence (1975), where the author shows that a monopolist choosing both price and quality tends "to be biased away from the social optimum because of possible differences between marginal and average valuations of quality by consumers".

[10] E.g., as argued above, advertisers who generate a negative externality on the side of readers.

[11] E.g., the author considers an application to the newspaper market: readers have positive membership value from reading the newspaper, but negative interaction value as they dislike ads; on the other hand, advertisers have positive interaction value (getting readers to see their ads), but negative membership value (establishing relationships with the newspaper is costly).

In conclusion, it may be argued that Weyl (2010) takes forward our understanding of the factors that drive the pricing choices of a platform in a two-sided market. While the previous literature rests on a view that stresses the importance of cross-side subsidization, Weyl (2010) formalizes the inability of a platform to fully internalize the externalities that arise in such a market, as it internalizes only the preferences of marginal users. In comparison with the previous literature, this result is obtained at the expense of analytical tractability. Nonetheless, the balance between the increased complexity and the significance of the result is still satisfactory.

These results may prove helpful for antitrust and regulatory issues, as the ongoing debates on Network Neutrality[12] and on the correct identification of predatory pricing show. With regard to the latter, Wright (2003) suggests that the usual criterion of price below marginal cost may be misleading in a two-sided context, as a consequence of cross-side subsidization. Weyl (2010) provides instead a more truthful measure, taking into account the size of the interaction benefit that users on a side provide to the others.

However, as the author himself points out, much work has still to be done in this path of research: it may be interesting to extend this framework to the case of competing platforms; the Spence distortion is not an issue when platforms can price discriminate, but an application on price-discrimination in two-sided markets is still missing; finally, while Weyl (2010) can be certainly considered a step forward in the theoretical modelling of two-sided markets, it is its own richness that may limit its applications in empirical research.

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[12] The Network Neutrality debate has concerned policy-makers and stakeholders of the Internet market in the last ten years, and aims at identifying the correct regulatory framework to apply to the relationship between Internet Service Providers, Content Providers and Internet users. An open question is the price that Internet Service Providers should be allowed to charge to Content Providers. For a review, see Schuett (2010).

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